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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/712,706	11/12/2003	David E. Root	10030379-1	9265

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EXAMINER	
PROCTOR, JASON SCOTT	
ART UNIT	**PAPER NUMBER**
2123	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	02/28/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/712,706	ROOT ET AL.	
	Examiner	Art Unit	
	Jason Proctor	2123	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 April 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *12 November 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *12/1/03*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claims 1-11 are presented for examination.

Claims 1-11 are rejected.

Oath/Declaration

1. In view of the papers filed of 9 April 2004, it has been found that this nonprovisional application, as filed, through error and without deceptive intent, improperly set forth the inventorship, and accordingly, this application has been corrected in compliance with 37 CFR 1.48(a). The inventorship of this application has been changed by adding inventor Jens Verspecht.

The application will be forwarded to the Office of Initial Patent Examination (OIPE) for issuance of a corrected filing receipt, and correction of Office records to reflect the inventorship as corrected.

Information Disclosure Statement

2. The information disclosure statement (IDS) submitted on 1 December 2003 is in compliance with 37 CFR 1.97 and is being considered by the examiner.

The reference A9, "Nonlinear Microwave Design; Extrapolating Beyond S-Parameters" by J.S. Kenny, is undated and therefore the citation does not comply with the requirements of 37 CFR 1.98. Accordingly, this citation has been lined through on the form PTO-1449, however the reference has been considered by the Examiner.

3. A search of the prior art has revealed several references deemed relevant to the patentability of the claimed invention which list at least one author who is a named inventor in this application. One such reference has been applied under 35 U.S.C. §§ 102 and 103 in prior art rejections of the claimed invention. None of these references have been cited by Applicants in an Information Disclosure Statement.

4. Applicants are reminded of the 37 CFR 1.56 duty to disclose information material to patentability.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. § 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 1-11 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

6. Claim 1 is rejected under 35 U.S.C. § 112, second paragraph, for the following reasons.

Claim 1 is indefinite for the terminology "$V_j(t)$" which is not described in the claim language. The disclosure reveals that each symbol V, j, and t has a special meaning in the disclosed invention. Referring to "a signal $V_j(t)$" mischaracterizes the disclosed invention.

Claim 1 is indefinite for the terminology "$f_k(V, a^k)$" which is not described in the claim language. Please see above.

Claim 1 is indefinite for the terminology "$I_k(t)$" which is not described in the claim language. Please see above.

Claim 1 is indefinite for the terminology "V(t)" and "the set of values V". It is unclear whether this constitutes improper antecedent basis.

Claim 1 is indefinite for the terminology "H" in the equation, which is not described by the claim language in any respect.

The Examiner respectfully suggests amending the claim language to contain an explanation of the symbols and terminology recited by the current claim 1, and as supported by the disclosure of the application.

The preamble sets forth "a method for generating a model of a circuit" however none of the limitations, alone or in combination, "generate a model of a circuit". The scope of the claim is indefinite with regard to whether the method generates a model of a circuit or, instead, "provid[es] a simulator component" as recited.

Claim 1 is incomplete for omitting essential steps, such omission amounting to a gap between the steps. See MPEP § 2172.01. The omitted steps are: the method of "using said determined amplitude to determine values of a set of constants, a^k, such that a function $f_k(V, a^k)$ provides an estimate of the current..." as claimed. The claim language does not describe the claimed function "$f_k(V, a^k)$" in a way that describes the invention. The claim language defines the constants "a^k" only in terms of the output of the claimed function. This claim language does not reveal the steps necessary to practice the claimed

invention. Specifically, this language does not allow one to "use a determined amplitude" to "determine the values for a set of constants, a^k" as required by the claim.

Claim 1 is incomplete for omitting essential steps, such omission amounting to a gap between the steps. See MPEP § 2172.01. The omitted steps are: the connection between "determining an amplitude," and "using said determined ampliute to determine values for a set of constants," as compared to "providing a simulator component". The claim provides no explanation of the origin, derivation, structure, or creation of the claimed "simulator component". The clause regarding "providing a simulator component" does not refer back to the previous method steps. There appears to be no connection between the "simulator component" and the previously recited steps.

This clause of the claim recites "said component returning a value $f_k(V, a^k)$". The use of the article "a" rather than "the" or "said" does not refer back to the previously recited "function $f_k(V, a^k)$. Amending this language to refer back to the previous limitation does not resolve the gap between the steps of "determining" and "using" as compared to the step of "providing".

Claim 1 is indefinite for the use of the conditional language "when". Although this language is not indefinite *per se*, it is indefinite in claim 1 because the alternative embodiments defined by the claim language lack antecedent basis or are otherwise unclear.

The claim scope encompasses a method with no steps when none of the recited conditions occur. That is, "when a signal comprising a carrier is [not] input to said input

port," "when a frequency having the form ... is [not] input to said input port," and "when said simulator [does not provide] values for V," the claimed invention is a method without any steps. Such a method must be regarded as indefinite.

The claim lacks proper antecedent basis when the first recited condition fails to occur. The claim specifies "determining an amplitude" when the first condition occurs. The claim subsequently recites "using said determined amplitude ... when a signal having the form ... is input to said input port." The claim does not absolutely require that the amplitude is determined, therefore using "said determined amplitude" dependent upon a second condition lacks proper antecedent basis.

Because the language "returning a value, $f_k(V, a^k)$" does not refer back to the previously recited limitation "a function $f_k(V, a^k)$", the conditional language in the "providing" step does not create a lack of antecedent basis. However, if this language is amended to refer back to the previously recited limitation, the claim will likely be indefinite for rationale similar to that found in the preceding paragraph.

Each of the preceding grounds of rejection is applied to claim 11 for similar rationale. The terminology of claim 11 including the additional symbol "p" is subject to similar grounds of rejection set forth for the terminology of claim 1.

7. Claim 2 is indefinite for the language "wherein said simulator also returns $f_k(V, a^k)$ via said simulator output port when said simulator provides values for V". This claim language further defines a method without any steps when the conditional statement is not met.

8. Claim 5 is indefinite because it is unclear how the limitation, "wherein the circuit simulator is a transient envelope simulator," limits the method of the parent claim. The parent claim 1 does not require any step of *simulation* by "a circuit simulator". The scope of claim 5 appears to be equivalent to the scope of the parent claim. Clarification is respectfully requested.

9. Claim 6 is indefinite because it is unclear how the limitation "wherein $f_k(V, a^k)$ is evaluated by a neural network that was trained with a training set comprising the determined amplitude" limits the method of the parent claim. It is unclear how this language is related to the limitations of the parent claim in any respect. It is unclear whether this language refers to the "function" or the "value" sharing the same terminology in claim 1.

10. Claim 7 is indefinite because it is unclear how the limitation "wherein $f_k(V, a^k)$ comprises a weighted sum of basis functions" limits the method of the parent claim. It is unclear how this language is related to the limitations of the parent claim in any respect. It is unclear whether this language refers to the "function" or the "value" sharing the same terminology in claim 1.

11. Claim 8 is indefinite because it is unclear how the limitation "wherein $f_k(V, a^k)$ further depends on an input derived from V..." limits the method of the parent claim. In the parent claim, there is no description of $f_k(V, a^k)$ depending on anything. In the parent

claim, the terminology "$f_k(V, a^k)$" is rejected as indefinite because there is no description of this terminology at all. It is further unclear whether this terminology in claim 8 refers to the "function" or the "value" sharing the same terminology in claim 1.

12. Claim 9 recites the limitation "said computational component" in lines 1-2. There is insufficient antecedent basis for this limitation in the claim.

13. Claim 10 is rejected under 35 U.S.C. § 112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements, such omission amounting to a gap between the necessary structural connections. See MPEP § 2172.01. The omitted structural cooperative relationships are: the connection and/or relationship between the "circuit component" recited by claim 10 and "said computational component". The language of the parent claim 8 makes no reference to "said computational component" having any connection or relationship to a "circuit component".

Claims rejected under this section but not specifically mentioned stand rejected by virtue of their dependence.

In general, the style of the claim language appears to encompass the admitted prior art while describing the disclosed invention when certain conditions arise. The Examiner respectfully submits that the scope of the disclosed invention is limited to the steps that are taken once it has been determined that the conditions are fulfilled. The

Examiner respectfully submits that, with respect to 35 U.S.C. § 112, second paragraph, the claims may be substantially improved by language that explicitly acknowledges that "a signal comprising a carrier..." "a signal having the form..." and "said simulator provides values..." must occur within the scope of the claim. This language would exclude the interpretation of a method with no steps and resolve several other deficiencies set forth above.

Claim Rejections - 35 USC § 101

35 U.S.C. § 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

14. Claims 1-11 are rejected under 35 U.S.C. § 101 because the claimed invention is directed to non-statutory subject matter.

Claim(s) 1-11 are directed to a method for generating a model of a circuit.

This claimed subject matter lacks a practical application of a judicial exception (law of nature, abstract idea, naturally occurring article/phenomenon) since it fails to produce a useful, concrete and tangible result.

Specifically, the claimed subject matter is not limited to a concrete result because the claimed subject matter fails to be limited to the production of an assured, repeatable result. More specifically, the claimed subject matter is not repeatable because the use of conditional language ("when") in each of the method steps defines a claim wherein none of the recited steps are performed. The result of the method under such a circumstance is unidentifiable from the claim language, and therefore not an assured, repeatable result.

Further, the claimed subject matter is not limited to a tangible result because the claimed subject matter fails to produce a result that is limited to having real world value rather than a result that may be interpreted to be abstract in nature as, for example, a thought, a computation, or manipulated data. More specifically, the claimed subject matter provides for "a simulator component". The claim is not explicitly limited to a tangible computer system comprising a simulator program. The claim language is at least broad enough to encompass an abstract definition of "a simulator component," such as the explicitly recited mathematical functions and values. This produced result remains in the abstract and, thus, fails to achieve the required status of having real world value.

To expedite a complete examination of the instant application the claims rejected under 35 U.S.C. § 101 (nonstatutory) above are further rejected as set forth below in anticipation of applicant amending these claims to place them within the four statutory categories of invention.

Claim Interpretation

Claims 1-11 have been rejected as indefinite under 35 U.S.C. § 112, second paragraph, and directed to non-statutory subject matter under 35 U.S.C. § 101. In the interest of compact prosecution, the claims are interpreted as best understood by the Examiner in light of the disclosure in order to apply prior art. That interpretation is shown below in the rejection under 35 U.S.C. § 102.

This interpretation is not an endorsement of claim language that complies with 35 U.S.C. §§ 112 and 101, but rather is merely the Examiner's best attempt at citing specific passages in the prior art corresponding to the elements of the claimed invention.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. § 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

15. Claims 1-10 are rejected under 35 U.S.C. § 102(a) as being anticipated by "New Techniques for Non-Linear Behavioral Modeling of Microwave/RD ICs from Simulation and Nonlinear Microwave Measurements" by David E. Root, John Wood, and Nick Tufillaro (hereafter referred to as "Root").

Regarding claim 1, Root discloses a method for generating a model of a circuit having an input port and an output port [*"nonlinear behavioral modeling techniques designed for microwave and RFIC applications"* (page 85, abstract); Figure 3 expressly depicting a circuit model with two input ports and two output ports; *"Behind all of the techniques described here is the notion that the behavioral model relates waveforms to waveforms... the output depends upon the shape of the input waveform, or equivalently, the output depends on the value of the input and past values of the input, and even past values of the output itself."* (page 86, § 2.3)]; said method comprising:

Providing a signal comprising a carrier at ω_j modulated by a signal $V_j(t)$ to said input port and determining a resulting amplitude of current leaving said output port at a frequency ω_k, wherein ω_k is a harmonic of ω_k [*"The model is based on the assumption of a harmonic balance solution of the circuit equations, which can therefore be written as*

Fourier Series according to Equations 1.7 and 1.8." (page 88, § 4.1); determining an amplitude is expressly shown in equation 1.7 or 1.10];

Providing a signal having the [claimed form] to said input port, where $V_k(t)$ is a component of the set of values V, and using said determined amplitude to determine values for a set of constant a^k, such that a function $f_k(V, a^k)$ provides an estimate of the current $I_k(t)$, leaving said output port at a frequency ω_k [(page 89, § 5); (pages 86-87, § 2.3, Equations 1.1-1.3); *"A describing function model can be defined by the complex mapping relation I_ks as nonlinear functions of the V_ks."* (page 88, § 4.1)];

Providing a circuit simulator [*"A key requirement is the ability for the modeler to interface with the envelope simulator* (page 89, § 5, third paragraph)];

Said circuit simulator providing values for V for at least one value of k at a first simulator input port of a simulator component, said simulator component returning a value $f_k(V, a^k)$ via a simulator output port in response to receiving said values for V [(page 89, § 5);].

Regarding claim 2, Root discloses that said circuit simulator provides values for V at said first simulator input port for at least two values of k and that said simulator component also returns $f_k(V, a^k)$ in response [Figure 3 expressly depicting a circuit model with two input ports and two output ports].

Regarding claim 3, Root discloses that said amplitude is determined by applying an electrical signal to said circuit and measuring a signal at said output port [*"behavioral*

models can be derived from real measurements made on the component." (page 86, § 2.1)].

Regarding claim 4, Root discloses that said amplitude is determined on a circuit simulator by simulating an electrical signal being applied to said circuit [*"The simulator can be used to stimulate the IC model and the responses used to derive a behavioral model for simulation at the next higher level of abstraction."* (page 86, § 2.1)].

Regarding claim 5, Root discloses that said circuit simulator is a transient envelope simulator [*"The transient envelope solution technique is efficient provided that the time varying coefficients vary slowly compared with the carriers... A key requirement is the ability for the modeler to interface with the envelope simulator."* (page 89, § 5)].

Regarding claim 6, Root discloses that $f_k(V, a^k)$ is evaluated by a neural network that was trained with a training set comprising said determined amplitude [*"Excellent results have been obtained from the DNN method for rf amplifiers and mixers... DNN models are nonlinear ordinary differential equations which can therefore be implemented in generic commercial time-domain simulators. The solution of the circuit equations can be obtained using any of the simulator algorithms including harmonic balance, transient envelope, and shooting methods in the time domain. Training, which is the process of determining the weights (or coefficients) in the basis set expansion for the ANNs, has been done in the time domain and in the frequency domain. Combined time and frequency domain training has also been reported."* (page 87, § 3.1)].

Regarding claim 7, Root discloses that $f_k(V, a^k)$ comprises a weighted sum of basis functions (pages 87-89, §§ 4-5)].

Regarding claim 8, Root discloses that $f_k(V, a^k)$ further depends on an input derived from V (page 89, §5) and wherein said simulator component further comprises a second simulator input port (Figure 3) and a computational component [as claimed] [*"Cascadability means that the cascade of two behavioral models performs faithfully with respect to the performance of the cascade of the respective components."* (page 86, § 2.2); i.e. a second component provides a cascading "derived value" to the simulator component].

Regarding claim 9, Root discloses that the signal generated by said computational component further depends on the time derivative of $I_k(t)$ for at least one value of k [*"the coefficients of this expansion can vary in time... These time-dependent coefficients are the complex envelopes..."* (page 89, § 5)].

Regarding claim 10, Root discloses that said computational component comprises a circuit component that is provided in a simulator component library [*"Transportability means the model can be used under a variety of different conditions, whether this refers to the signals stimulating the model or the environments in which the behavioral model is to be placed in the intended application."* (page 86, § 2.2); i.e. the model can be retrieved [from a library or other storage] and used in a different environment].

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. § 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. § 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. § 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. § 103(c) and potential 35 U.S.C. § 102(e), (f) or (g) prior art under 35 U.S.C. § 103(a).

16. Claim 11 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Root.

Claim 11 is rejected for the rationale set forth in the rejection of claim 1 above, and additionally:

Root does not appear to expressly disclose the equations recited by claim 11 including the notation for the p^{th} output port.

Root expressly teaches the claimed equations for at least the single output port version of the invention, as shown above. Root further expressly discloses a circuit model with multiple output ports (Figure 3).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of Applicants' invention to modify the equations expressly taught by Root as necessary to produce the embodiment with multiple output ports. Motivation to do so is expressly found in the reference by virtue of the coincident disclosure of the circuit model with multiple output ports in Figure 3 and the advantages of the envelope methods (page 89, § 5).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of Applicants' invention to combine the embodiments disclosed by Root to arrive at the invention specified by claim 11.

Conclusion

Art considered pertinent by the examiner but not applied has been cited on form PTO-892.

"The Behavioral Modeling of Microwave/RF ICs using Nonlinear Time Series Analysis" by John Wood and David E. Root (June 2003) discloses subject matter relevant to the claimed invention.

"Systematic behavioral modeling of nonlinear microwave/RF circuits in the time domain using techniques from nonlinear dynamical systems" by David E. Root, John Wood, Nick Tufillaro, Dominque Schreurs, and Alexander Pekker (2002) discloses subject matter relevant to the claimed invention.

"The Construction and Evaluation of Behavioral Models for Microwave Devices Based on Time-Domain Large-Signal Measurements" by D. Schreurs, J. Wood, N. Tufillaro, D. Usikov, L. Barford, and D.E. Root (2000) discloses subject matter relevant to the claimed invention.

"Describing Functions Can Better Model Hard Nonlinearities In The Frequency Domain Than The Volterra Theory" by Jens Verspecht (1995) discloses subject matter relevant to the claimed invention.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason Proctor whose telephone number is (571) 272-3713. The examiner can normally be reached on 8:30 am-4:30 pm M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Rodriguez can be reached at (571) 272-3753. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Any inquiry of a general nature or relating to the status of this application should be directed to the TC 2100 Group receptionist: 571-272-2100. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jason Proctor
Examiner
Art Unit 2123

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2/22/07

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